WHAT IS CLAIMED IS:

1. An adaptive transmit method of a transmitter in a wireless communication system with multiple antennas for transmitting data to a receiver with a plurality of receive antennas from the transmitter with a plurality of transmit antennas through an MIMO (multiple input multiple output) channel, comprising:

(a) determining a channel coding method, a modulation method, and an antenna transmit method so as to support different data rates according to a characteristic of the MIMO channel, wherein the channel coding method, the modulation method, and the antenna transmit method are classified according to a main transmit mode for supporting different data rates, and the main transmit mode includes either or both of a sub-transmit mode based on the STBC (space time block code) and a sub-transmit mode based on the SM (spatial multiplexing);

(b) encoding input data according to the determined main transmit mode;

(c) modulating the data encoded in (b) according to the determined sub-transmit mode, mapping them to modulation symbols, and outputting results; and

(d) mapping the data modulated in (c) to symbol vectors to be transmitted through each transmit antenna according to the determined sub-transmit mode, and outputting results.

2. The adaptive transmit method of claim 1, wherein the characteristic of the MIMO channel is indicated by an antenna transmit performance

parameter produced and fed back by the receiver.

3. The adaptive transmit method of claim 1, wherein (a) comprises: determining a main transmit mode that provides the highest data rates from among the transmit modes (which include the main transmit mode and the sub-transmit mode) that satisfy the performance required according to the characteristic of the MIMO channel, and determining a sub-transmit mode for reducing a transmit power from the determined main transmit mode.

4. The adaptive transmit method of claim 1, wherein (d) comprises: performing antenna mapping based on STBC when performing symbol mapping having a first symbol constellation on the same main transmit mode in (c), and

(d) comprises: performing antenna mapping based on SM when performing symbol mapping having a second symbol constellation on the same main transmit mode in (c).

5. The adaptive transmit method of claim 1, wherein (a) comprises:

(i) comparing an STBC performance parameter which is one of parameters for showing the characteristic of the MIMO channel with a previously stored STBC threshold value to select one of the main transmit modes having a sub-transmit mode based on the STBC;

(ii) comparing an SM performance parameter, which is one of parameters for showing the characteristic of the MIMO channel, with a previously stored SM threshold value to select one of the main transmit modes having a sub-transmit mode based on the SM; and

(iii) comparing the main transmit mode selected in (i) with the main

transmit mode selected in (ii) to determine a final transmit mode (which includes a main transmit mode and a sub-transmit.

6. The adaptive transmit method of claim 5, wherein (i) comprises: selecting a main transmit mode which has a minimum positive number obtained by subtracting the STBC threshold value from the STBC performance parameter, and

(ii) comprises: selecting a main transmit mode which has a minimum positive number obtained by subtracting the SM threshold value from the SM performance parameter.

7. The adaptive transmit method of claim 5, wherein the main transmit mode has indexes in the ascending order of data rates, and

(iii) comprises:

determining whether the main transmit mode selected in (i) is greater than the main transmit mode selected in (ii);

determining the main transmit mode selected in (i) and a sub-transmit mode based on STBC of the selected main transmit mode as final transmit modes (which include a main transmit mode and a sub-transmit mode), when the main transmit mode selected in (i) is greater than the main transmit mode selected in (ii); and

determining the main transmit mode selected in (i) and a sub-transmit mode based on STBC of the selected main transmit mode as final transmit modes (which include a main transmit mode and a sub-transmit mode), when the main transmit mode selected in (i) is matched with the main transmit mode selected in (ii), and the value obtained by subtracting the STBC threshold value

from the STBC performance parameter is greater than the value obtained by subtracting the SM threshold value from the SM performance parameter.

8. The adaptive transmit method of claim 7, comprising:

determining the main transmit mode selected in (ii) and a sub-transmit mode based on SM of the selected main transmit mode as final transmit modes (which include a main transmit mode and a sub-transmit mode), when the main transmit mode selected in (ii) is greater than the main transmit mode selected in (i); and

determining the main transmit mode selected in (ii) and a sub-transmit mode based on SM of the selected main transmit mode as final transmit modes (which include a main transmit mode and a sub-transmit mode), when the main transmit mode selected in (i) is matched with the main transmit mode selected in (ii), and the value obtained by subtracting the SM threshold value from the SM performance parameter is greater than the value obtained by subtracting the STBC threshold value from the STBC performance parameter.

9. An adaptive receiving method of a receiver in a wireless communication system with multiple antennas for transmitting data to the receiver with a plurality of receive antennas from a transmitter with a plurality of transmit antennas through an MIMO (multiple input multiple output) channel, comprising:

(a) extracting symbol information for each antenna from a signal received through the MIMO channel according to a channel coding method, a modulation method, and an antenna transmit method determined by the transmitter so as to support different data rates according to a characteristic of

the MIMO channel, wherein the channel coding method, the modulation method, and the antenna transmit method are classified according to a main transmit mode for supporting different data rates, and the main transmit mode includes either or both of a sub-transmit mode based on the STBC (space time block code) and a sub-transmit mode based on the SM (spatial multiplexing);

(b) performing channel decoding according to the extracted symbol information for each transmit antenna, and estimating transmitted data information; and

(c) extracting a parameter used by the transmitter for determining the channel coding method, the modulation method, and the antenna transmit method by using an MIMO channel response estimated from the signal received through the MIMO channel.

10. The adaptive receive method of claim 9, wherein (c) comprises:

(i) calculating an STBC performance parameter which is one of parameters for showing characteristics of the MIMO channel by using the estimated MIMO channel response; and

(ii) calculating an SM performance parameter which is one of parameters for showing the characteristics of the MIMO channel by using the estimated MIMO channel response.

11. The adaptive receive method of claim 10, wherein (i) comprises:

calculating a channel power sum by using the estimated MIMO channel response; and

calculating the STBC performance parameter by combining the calculated channel power sum with the estimated MIMO channel response.

12. The adaptive receive method of claim 11, wherein the STBC performance parameter SB satisfies the subsequent equation:

$$S_B = 10\log_{10}(SNR_{SBC}) = 10\log_{10}\left(\frac{\|\mathbf{H}\|^2}{M}\frac{E_S}{N_0}\right)$$

where $\|\mathbf{H}\|^2 = \sum_{p=1}^{N}\sum_{q=1}^{M}\|h_{p,q}\|^2$,

$\mathbf{H} = \begin{bmatrix} h_{1,1} & h_{1,2} & \cdots & h_{1,M} \\ h_{2,1} & h_{2,2} & \cdots & h_{2,M} \\ \vdots & \vdots & \ddots & \vdots \\ h_{N,1} & h_{N,2} & \cdots & h_{N,M} \end{bmatrix}$ is an MIMO channel response,

E_S is a transmit symbol energy, and N_0 is distribution of complex additive white noise.

13. The adaptive receive method of claim 10, wherein (i) comprises:

calculating a linear equalization matrix by using the estimated MIMO channel response;

calculating a transmit antenna post-processing SNR by using the calculated linear equalization matrix; and

calculating the SM performance parameter by using the calculated transmit antenna post-processing SNR.

14. The adaptive receive method of claim 13, wherein the linear equalization matrix $\mathbf{G}$ follows the equation $\mathbf{G} = (\mathbf{H}^H\mathbf{H})^{-1}\mathbf{H}^H$ in the case of a ZF (zero forcing) linear equalization criterion.

15. The adaptive receive method of claim 13, wherein the linear equalization matrix $\mathbf{G}$ follows the equation $\mathbf{G} = \left(\mathbf{H}^H\mathbf{H} + \frac{N_0}{ME_S}\mathbf{I}_M\right)^{-1}\mathbf{H}^H$ in the

case of a MMSE (minimum mean square error) linear equalization criterion.

16. The adaptive receive method of claim 14, wherein the transmit antenna post-processing SNR follows the equation $\mathrm{SNR}_{SM,q} = \frac{E_S \mathbf{g}_q^H \mathbf{h}_q}{MN_0 + E_S \sum_{j \neq q} \mathbf{g}_q^H \mathbf{h}_j}$

where $\mathrm{SNR}_{SM,q}$ is a post-processing SNR of the symbol transmitted to the q-th transmit antenna, $\mathbf{h}_q$ is the q-th column vector of $\mathbf{H}$, and $\mathbf{g}_q$ is the q-th column vector of the linear equalization matrix $\mathbf{G}$.

17. The adaptive receive method of claim 16, wherein the SM performance parameter S_M follows the equation $S_M \min_q 10\log_{10}(\mathrm{SNR}_{SM,q})$ in the case of setting the minimum value of the antenna post-processing SNR as a reference.

18. The adaptive receive method of claim 16, wherein the SM performance parameter S_M follows the equation $S_M = \frac{1}{M}\sum_{q=1}^{M} 10\log_{10}(\mathrm{SNR}_{SM,q})$ in the case of setting the geometric mean of the antenna post-processing SNR as a reference.

19. The adaptive receive method of claim 17, wherein in the case that a number of the transmit antennas is 2, and a number of the receive antennas is greater than 3, when the transmit antenna post-processing SNR calculated based on the ZF linear equalization criterion is given as the equation $\mathrm{SNR}_{SM,q} = \frac{1}{2(\mathbf{H}^H\mathbf{H})_{qq}^{-1}} \frac{E_S}{N_0} = \alpha_q(1-\rho^2)\mathrm{SNR}_{SBC}$ where $\mathbf{A}_{qq}^{-1}$ is the (q,q)-th element of

$\mathbf{A}^{-1}$, $\alpha_q = \frac{\|\mathbf{h}_q\|^2}{\|\mathbf{H}\|^2}$ is a channel power ratio of the q-th transmit antenna, $\rho = \frac{\|\mathbf{h}_1^H \mathbf{h}_2\|}{\|\mathbf{h}_1\|\|\mathbf{h}_2\|}$ is a channel correlation between two transmit antennas, and $\|\mathbf{v}\|$ is a norm of $\mathbf{v}$, the SM performance parameter S_M in the case of setting the minimum value of the antenna post-processing SNR as a reference follows the equation $S_M = 10\log_{10}(\alpha_{\min}(1-\rho^2)) + S_B$ where $\alpha_{\min} = \min_q \alpha_q$.

20. The adaptive receive method of claim 18, wherein in the case that a number of the transmit antennas is 2, and a number of the receive antennas is greater than 3, when the transmit antenna post-processing SNR calculated based on the ZF linear equalization criterion is given as the equation $\mathrm{SNR}_{SM,q} = \frac{1}{2(\mathbf{H}^H\mathbf{H})^{-1}_{qq}} \frac{E_S}{N_0} = \alpha_q(1-\rho^2)\mathrm{SNR}_{SBC}$ where $\mathbf{A}^{-1}_{qq}$ is the (q,q)-th element of $\mathbf{A}^{-1}$, $\alpha_q = \frac{\|\mathbf{h}_q\|^2}{\|\mathbf{H}\|^2}$ is a channel power ratio of the q-th transmit antenna, $\rho = \frac{\|\mathbf{h}_1^H \mathbf{h}_2\|}{\|\mathbf{h}_1\|\|\mathbf{h}_2\|}$ is a channel correlation between two transmit antennas, and $\|\mathbf{v}\|$ is a norm of $\mathbf{v}$, the SM performance parameter S_M in the case of setting the geometric mean of the antenna post-processing SNR as a reference follows the equation $S_M = 10\log_{10}\left(\sqrt{\alpha_1\alpha_2}(1-\rho^2)\right) + S_B$ where α_1 and α_2 are channel power ratio for each transmit antenna, and ρ is a channel correlation of the transmit antenna.

21. An adaptive transmit device in a wireless communication system

with multiple antennas for transmitting data to a receiver with a plurality of receive antennas from a transmitter with a plurality of transmit antennas through an MIMO (multiple input multiple output) channel, comprising:

an adaptive transmit controller for determining a channel coding method, a modulation method, and an antenna transmit method so as to support different data rates according to a characteristic of the MIMO channel, wherein the channel encoding method, the modulation method, and the antenna transmit method are classified according to a main transmit mode for supporting different data rates, and the main transmit mode includes either or both of a sub-transmit mode based on the STBC (space time block code) and a sub-transmit mode based on the SM (spatial multiplexing);

a channel encoder for encoding data input according to the channel encoding method determined by the adaptive transmit controller, and outputting results;

a symbol mapper for modulating the data encoded by the channel encoder according to the modulation method determined by the adaptive transmit controller, mapping them to modulation symbols, and outputting results; and

an antenna mapper for mapping the data modulated by the symbol mapper to symbol vectors to be transmitted through each transmit antenna according to the antenna transmit method determined by the adaptive transmit controller, and outputting results.

22. The adaptive transmit device of claim 21, wherein the symbol mapper comprises: a first symbol mapper for modulating the data output by the

channel encoder to a first symbol constellation, and outputting results; and a second symbol mapper for modulating the data output by the channel encoder to a second symbol constellation, and outputting results,

the antenna mapper comprises: a first antenna mapper for antenna-mapping the data modulated by the first symbol mapper according to the STBC method; and a second antenna mapper for antenna-mapping the data modulated by the second symbol mapper according to the SM method, and

the adaptive transmit device further comprises: a demultiplexer for connecting the output of the channel encoder to one of the first and second symbol mappers according to the modulation method determined by the adaptive transmit controller; and a multiplexer for selecting one of the outputs of the first and second antenna mappers according to the antenna transmit method determined by the adaptive transmit controller.

23. The adaptive transmit device of claim 21, wherein the adaptive transmit controller comprises:

an STBC threshold value lookup table for storing threshold values of STBC;

an SM threshold value lookup table for storing threshold values of SM;

an STBC transmit mode selector for comparing an STBC performance parameter fed back from the receiver with a threshold value stored in the STBC threshold value lookup table to select one of the main transmit modes;

an SM transmit mode selector for comparing an SM performance parameter fed back from the receiver with a threshold value stored in the SM threshold value lookup table to select one of the main transmit modes; and

a comparator for comparing the main transmit mode selected by the STBC transmit mode selector with the main transmit mode selected by the SM transmit mode selector to determine final transmit modes (which include a main transmit mode and a sub-transmit mode).

24. An adaptive receive device in a wireless communication system with multiple antennas for transmitting data to a receiver with a plurality of receive antennas from a transmitter with a plurality of transmit antennas through an MIMO (multiple input multiple output) channel, comprising:

an antenna/symbol demodulator for extracting symbol information for each antenna from a signal received through the MIMO channel according to a channel coding method, a modulation method, and an antenna transmit method determined by the transmitter so as to support different data rates according to a characteristic of the MIMO channel, wherein the channel coding method, the modulation method, and the antenna transmit method are classified according to a main transmit mode for supporting different data rates, and the main transmit mode includes either or both of a sub-transmit mode based on the STBC (space time block code) and a sub-transmit mode based on the SM (spatial multiplexing);

a channel decoder for performing channel decoding according to the symbol information for each transmit antenna extracted by the antenna/symbol demodulator, estimating transmitted data information, and outputting results;

a channel estimator for estimating an MIMO channel response from a signal received through the MIMO channel; and

an adaptive transmit parameter extractor for extracting a parameter

used by the transmitter for determining the channel coding method, the modulation method, and the antenna transmit method by using the MIMO channel response estimated by the channel estimator.

25. The adaptive receive device of claim 24, wherein the adaptive transmit parameter extractor comprises:

an STBC performance parameter calculator for calculating an STBC performance parameter by using an MIMO channel response estimated by the channel estimator; and

an SM performance parameter calculator for calculating an SM performance parameter by using the MIMO channel response estimated by the channel estimator.

26. The adaptive receive device of claim 25, wherein the STBC performance parameter calculator comprises:

a channel power sum calculator for calculating a channel power sum by using the MIMO channel response estimated by the channel estimator; and

a combiner for combining the channel power sum calculated by the channel power sum calculator with the MIMO channel response estimated by the channel estimator to calculate the STBC performance parameter.

27. The adaptive receive device of claim 25, wherein the SM performance parameter calculator comprises:

a linear equalizer for calculating a linear equalization matrix by using the MIMO channel response estimated by the channel estimator;

an SM post-processing SNR calculator for calculating a transmit antenna post-processing SNR by using the linear equalization matrix calculated

by the linear equalizer; and

a representative calculator for calculating a representative of the SM performance parameter by using the transmit antenna post-processing SNR calculated by the SM post-processing SNR calculator.

28. The adaptive receive device of claim 24, wherein the antenna/symbol demodulator performs orthogonal diversity combination by using the MIMO channel response estimated by the channel estimator to detect transmit symbols when the antenna transmit method determined by the transmitter is a space encoding method, and to detect the transmit symbols by using one of the ML (maximum likelihood) detection method, the OSIC (ordered successive interference canceller) detection method, the MMSE (minimum mean square error) linear equalization method, and the ZF (zero forcing equalizer) linear equalization method when the antenna transmit method determined by the transmitter is an SM method.